The Importance of Spatial Statistics in Regional Modeling

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Energy Efficiency and Renewable Energy
And
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Spatial and Temporal Issues to Surrounding Energy Analysis

- Energy models built in the 1970s and 1980s were designed to model dispatchable technologies
  - Base, intermediate and peaker
  - Determination of profitability based on daily-monthly supply and demand
  - Regulated markets for electricity
- The 1990s modifications added some capabilities to handle parts of deregulation
  - Temporal data (day vs night)
  - Average annual or monthly prices
  - Average annual capacity factors for renewables and intermittent technologies

Why Spatial Statistics Can Improve Modeling

- Trend is toward demand side pricing with hourly price changes
- Renewables and storage need hourly price and resource availability information to accurately model penetration
- High resolution data is costly to obtain and may not reflect conditions decades out (climate change)

Energy Modeling Today and Future Energy Systems

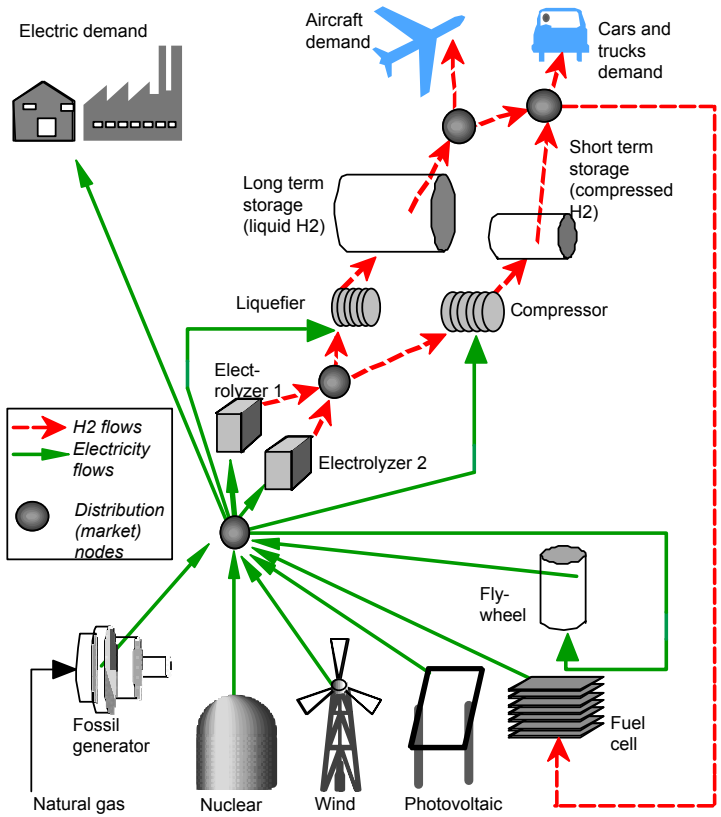
- Not designed for hourly changes
- Cannot capture impacts of R&D
- Do not capture major changes to energy economy such as hydrogen penetration
- Hourly pricing
- Central and distributed options
- Intermittent and storage
- Electricity use for transportation
- Hydrogen and other fuels

Fusing Data Sets

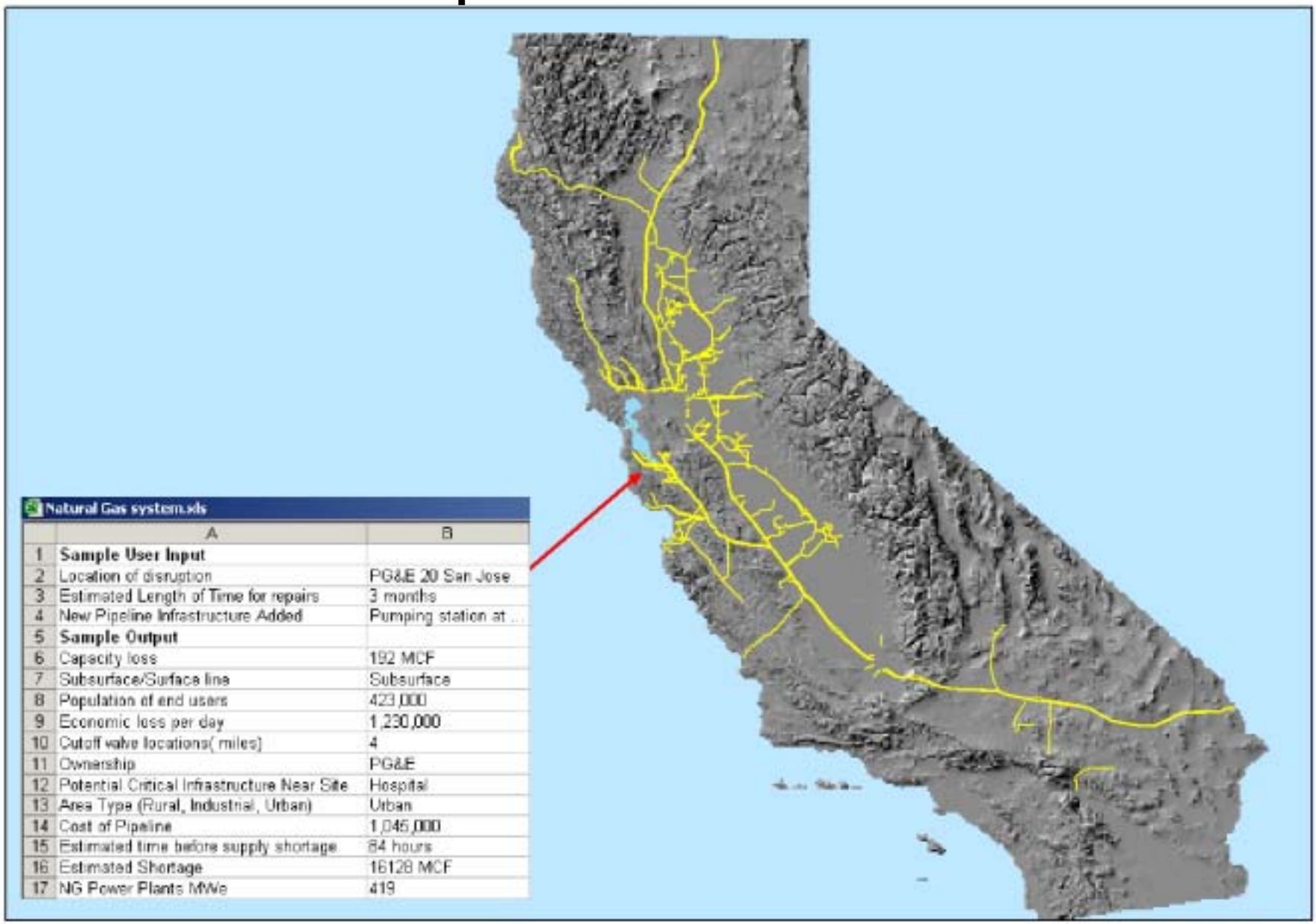
- Data sets at different spatial and temporal scales can be used to create a model for synthetic data.
  - Course wind data from weather stations.
  - High resolution satellite data for temperature.
  - High resolution topography and pressure field data.
- Results in a probability distribution of wind speeds at finer spatial and temporal resolution.

Example of a system possible future energy system

- Hourly data:electricity demand, short term H storage, renewable resource
- Spatial data for H storage and demand, wind and solar resources
- Daily to annual for fossil generation



Mapping the Economic Value of Natural Gas Pipelines and Infrastructure



Natural Gas system.xls

	A	B
1	**Sample User Input**	
2	Location of disruption	PG&E 20 San Jose
3	Estimated Length of Time for repairs	3 months
4	New Pipeline Infrastructure Added	Pumping station at ...
5	**Sample Output**	
6	Capacity loss	192 MCF
7	Subsurface/Surface line	Subsurface
8	Population of end users	423,000
9	Economic loss per day	1,230,000
10	Cutoff valve locations(miles)	4
11	Ownership	PG&E
12	Potential Critical Infrastructure Near Site	Hospital
13	Area Type (Rural, Industrial, Urban)	Urban
14	Cost of Pipeline	1,045,000
15	Estimated time before supply shortage	84 hours
16	Estimated Shortage	16128 MCF
17	NG Power Plants MWe	419

Satellite and GIS Datasets Used to Estimated Damage